morphological feature of as-prepared Al-doped ZnO nanorods. Energy dispersive spectrum (EDS) gives the chemical composition and XRD reveals the wrutzite structure with secondary phase. Band gap energy is found to be increased marginally at the Al concentration of 8 mol% due to Burstein-Moss effect. PL spectra show a new emission peak at 605nm (orange emission) due to the incorporation of Al^{3+} ions. Raman spectra show that the Al doping suppressed the A_1 (TO) and E_1 (TO) modes and enhance the second order Raman peaks arising from zone boundary phonons. Analysis of ac conductivity with frequency and temperature give more insight on the enhanced electrical properties of Al-doped ZnO nanorods.

Chapter 8 discusses briefly the synthesis, morphology, structural, optical and electrical properties of different semiconductor nanostructures such as $Zn_{(1-x)}Mn_xO$, $Zn_{(1-x)}Co_xO$, $Zn_{(1-x)}Fe_xO$ and $Zn_{(1-x)}Ni_xO$. Synthesis of these transition metal(TM) doped ZnO nanostructures ($Zn_{(1-x)}TM_xO$) with dopant concentration x = 2mol%, 5mol% and 8mol% have been conducted using hydrothermal method. TEM images, SAED pattern and EDS have been used to obtain the morphology, crystalline nature and chemical composition. The optical features of TM doped ZnO nanostructures have been investigated using UV-visible absorption, Photoluminescence and Raman spectroscopy. The spectral characteristics of dopant ions (Mn^{2+}, Co^{2+}, Fe^{2+} and Ni^{2+}) incorporated in the host ZnO lattice have been discussed in detail. The behaviour of ac conductivity of TM doped ZnO nanorods with varying frequency, and dopant concentrations have also discussed.

The research work presented in the thesis and the related work have either been published in or communicated to following journals. Besides, part of the work has been presented in various national and international seminars.

List of papers published in or communicated

1. Optical phonon confinement in ZnO nanorods and nanotubes, Soosen Samuel M, Jiji Koshy, Anoop Chandran and K C George, Indian Journal of Pure and Applied Physics, 48 (2010) 703-708.

2. Dielectric Behaviour and Transport Properties of ZnO Nanorods, Soosen Samuel M, Jiji Koshy, Anoop Chandran and K C George, Physica B: Condensed Matter, 406 (2011) 3023-3029.
3. Electrical charge transport and dielectric response in ZnO nanotubes, Soosen Samuel M, Jiji Koshy, Anoop Chandran and K C George, Current Applied Physics, 11 (2011) 1094-1099.
4. Correlated barrier hopping in ZnO nanorods**,** Samuel M. Soosen, Anoop Chandran, Jiji Koshy, and K. C. George , Journal of Applied Physics, 109 (2011) 113702(1-5).
5. Correlated Barrier Hopping in ZnO nanotubes, Soosen Samuel M, Anoop Chandran, Jiji Koshy, and K. C. George, AIP conference Proceedings No. 1349 (AIP, Newyork, 2011)
6. Optical properties of Al-doped ZnO nanorods, Soosen Samuel M, Anoop Chandran, Jiji Koshy, and K. C. George, AIP conference Proceedings, Optics\'11, NIT Calicut.
7. Optical properties of ZnO nanoparticles, Soosen Samuel M, Lakshmi Bose, K.C George, SB Academic Review, XV1 (2009). ISSN: 0973-7464.
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9. Dielectric relaxation behaviour of CdS nanoparticles and nanowires, Anoop Chandran, Soosen Samuel M, Jiji Koshy, and K C George, Journal of Material Science, 46 (2011) 4646-4653.
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11. Optical properties of CuO nanoparticles, Jiji Koshy, Soosen Samuel M, Anoop Chandran and K C George, AIP conference Proceedings, Optics\'11, NIT Calicut.
12. Spectroscopic investigation of transformation from ZnO nanorods to nanotubes, Soosen Samuel M, Jiji Koshy, Anoop Chandran, Pournami Vijayan and K C George, Journal of material science (communicated)
13. The effect of Mn doping on structural, optical and electrical Properties of ZnO nanorods, Soosen Samuel M, Anoop Chandran, Jiji Koshy, Pournami Vijayan and K C George, Current

Applied Physics (communicated).

14. Influence of Co doping on structural, and photoluminescence properties of Co doped ZnO nanorods, Soosen Samuel M, Jiji Koshy, Anoop Chandran, Pournami Vijayan and K C George, Optical Materials (communicated).
15. Electrical properties of pure and TM-doped ZnO nanorods (TM= Mn, Co, Fe and Ni), Soosen Samuel M, Anoop Chandran, Jiji Koshy, Pournami Vijayan and K C George, Material Letters (Communicated)
16. Structural, Optical and Electrical Properties of Fe doped ZnO nanorods, Soosen Samuel M, Anoop Chandran, Jiji Koshy, Pournami Vijayan and K C George, Solid state communications (communicated).
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18. Tuning the luminescence property of TM doped ZnO nanorods (TM= Mn, Co, Fe and Ni), Soosen Samuel M, Anoop Chandran, Jiji Koshy, Pournami Vijayan and K C George, Chemical Physics letters (Communicated).

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1. Spectroscopic investigation of transformation of Zinc Oxide nanorods to nanotubes synthesized by hydrothermal reaction, M. Soosen Samuel, P.M Sudeep, Priyanka Varghuse, Hredya L Nath , Anu Kuruvilla and K C George, International Conference on NANO science and technology , Chennai (ICONSAT-2008) February 27-29, 2008.
2. Comparative study of optical properties of ZnO nanoparticles, nanorods and nanotubes, Soosen Samuel M, Pournami Vijayan , Jiji Koshy, Anoop Chandran and K. C. George, Second International Conference on Frontiers in Nano Science and Technology, Cochi (COCHIN NANO-2009) January 3-6, 2009.

3. A Comparative study of ac conductivity of ZnO nanorods and nanotubes, Soosen Samuel M, Pournami Vijayan, Jiji Koshy, Anoop Chandran and K. C. George, International Conference on Advanced Functional Materials, Thiruvanathapuram (ICAFM-2009) December 9-12, 2009 (accepted).
4. Enhanced ac conductivity of ZnO nanorods and nanotubes, Soosen Samuel M, Jiji Koshy, Anoop Chandran and K. C. George, International conference on Recent Trends in materials Science and technology, Thiruvanathapuram (ICMST-2010) October 29-31, 2010.
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6. Optical properties of Al-doped ZnO nanorods, Soosen Samuel M, Anoop Chandran, Jiji Koshy, and K. C. George, International Conference on Light, NIT Calicut (Optics\'11) May 23-25, 2011.
7. Synthesis, structure and optical properties of ZnO nanoparticles, Soosen Samuel M, Anoop Chandran, Jiji Koshy, and K. C. George, National Workshop on Quantum Confined Systems and Nanoscale Devices-2009, St Thomas College, Pala, December 3-5, 2009.
8. Fabrication, structure and optical properties of Zinc Oxide nanotubes synthesized by hydrothermal reaction, M. Soosen Samuel, P.M Sudeep, Priyanka Varghuse, Hredya L Nath , Anu Kuruvilla and K C George, National Seminar on Optoelectronic Phenomena, St Aloysius' College, Edathua (NSOP-2007) August 10-12, 2007.